FOREST Management BULLETIN
SOUTHEASTERN AREA

WATERSHED MANAGEMENT FOR SMALL FOREST LANDOWNERS

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INTRODUCTION

It is not the phosphates, not mercury, not DDT but sediment that is the greatest pollutant found in streams and lakes today. This sediment has been produced by excessive runoff from incorrectly tilled fields, denuded hillsides, dirt roads, and unstable roadbanks — or in other words: poor land use.

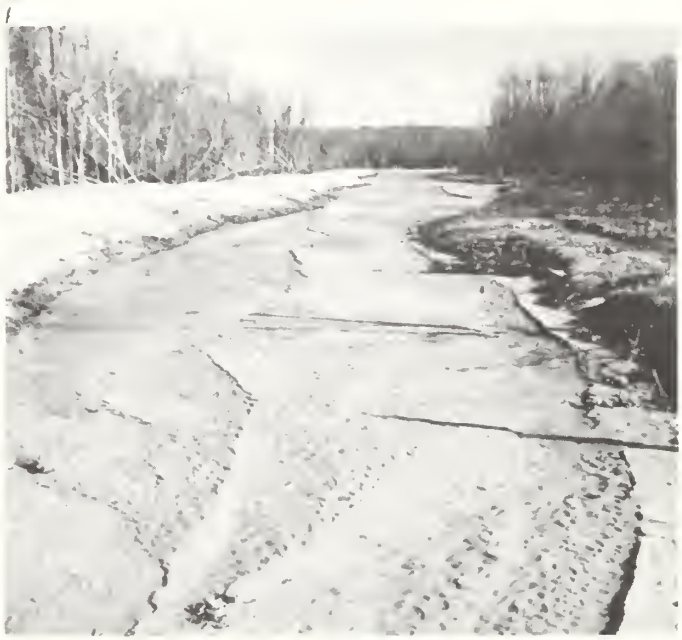
What, then, is good land use for watershed management purposes? Self-initiated zoning of one's property, for one thing. Put timber on the hills, graze the gently rolling land, and limit crops to the bottoms or the upland flats.

In planning watershed management of forest lands, it should be remembered that such management can entail more than one objective. In addition to improving water quality, it can **reduce** or **increase** the availability of water to meet the management objective, be it timber production, recreation, wildlife, or grass.

Reducing Surface Runoff

The key to reducing surface runoff from forest lands lies in proper management of the forest floor (including the litter produced by lesser vegetation). Starting with bare soil, accumulating forest litter effectively stops soil movement and begins to reduce runoff within three to five years. The infiltration continues to increase with time as organic matter is incorporated into the surface soil, thus further reducing runoff. Of course, the forest floor must be protected from excessive disturbances to accomplish these improvements.

Loblolly pine is the species most widely planted for erosion control on pine lands in the South. Litter studies have shown that by the time a loblolly plantation is eight years old, the forest floor is adequately protected with from four to five tons (dry weight) per acre of pine needles, twigs, and grass. On 82 percent of the plots in stands 10 years and older, a thin organic soil layer had begun to form and there was ample evidence of earthworm activity. Thus not only do loblolly pine plantations provide rapid protection of the site from erosion but, by ameliorating the surface soil, they improve the infiltration rate.



Result of Poor Land Use. *Denuded hillsides, improper road construction and other mistakes cause sediment to clog streams. Key to reducing surface runoff from forest lands lies in proper management of the forest floor. Forest litter reduces runoff.*

Well-stocked pine plantations (100 sq. ft. of basal area per acre) will annually intercept approximately six inches of rainfall and reduce the total impact of rain on the soil surface. The litter under a pine plantation slows runoff, permitting greater infiltration. It also stores some of the moisture, and thereby reduces surface runoff. In fact, once a good stable litter covers the floor, surface runoff is virtually eliminated where the soil is of coarse to medium texture and no internal drainage restrictions are present.

Hardwood leaves also maintain a porous, protective mantle over the bare earth and improve the permeability of the surface layers of soil, but all species are not equally effective. Leaves with high calcium content undergo rapid and relatively complete decomposition, providing a high level of nutrients. Such species include dogwood, ash, yellow-poplar, redbud, sweetgum, and hickory. Those whose leaves decompose slowly and incompletely are white oak, post oak, red oak, black oak, and blackjack oak.

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The late T. S. Coile computed a decomposition factor of various species whereby the factor number increases with the rate of decomposition. Some examples:

90+	Dogwood
30+	Hickory
10+	Yellow-poplar, red cedar, white ash
5+	Sycamore, northern red oak, black sweetgum
1+	Red maple, post oak, shortleaf pine, blackjack oak, loblolly pine

The message is clear: Plant loblolly pine to provide a quick, porous and long lasting cover on pine land, and favor dogwood, hickory, yellow-poplar, and white ash where present for soil building purposes. Note that a good understory of dogwood, for example, will increase the decomposition rating of the litter in a pine stand to that of white ash.

Caution should be used, however, in citing the magnitude of hydrologic benefits due to planting pine. Runoff is affected by the amount, intensity, and timing of rainfall, as well as soil moisture content of the soil at the time of the rains. Soil type and the condition of the forest floor are also important. Runoff from soils with a high clay content over a fragipan, for example, will be substantial regardless of the cover.

Timber Management and Water

The Southern Forest Experiment Station has conducted research on what happens to the rainfall in forested stands in the mid-South. Removing 20 square feet of basal area from a loblolly pine stand in northern Mississippi, where annual rainfall averages 52 inches, increased rainfall reaching the ground by slightly more than 1 inch per year. Thinning the stand from 150 to 70 square feet of basal area increased throughfall by 4 inches.

During the winter months, pine stands use less than one inch of water per month. Water loss through evapotranspiration increases to about three inches per month in the spring and to as much as eight inches per month in hot weather so long as the soil is moist. By mid-July the water loss may have been cut back to three inches per month and by mid-September to less than one inch per month because of decreased soil moisture. In a year of normal rainfall in the mid-South a pine stand transpires and evaporates 35 acre-inches of water. Conceivably in a dry year as little as 10 inches of the annual rainfall would be left to sustain the flow of streams or contribute to ground storage.

Thinning a fully stocked pine stand so that one-half of the crown area is removed will permit more of the rainfall to reach the soil and will result in a small draft on the soil water during hot weather. Thus in most years, water will be available in the soil in recently thinned stands to support tree growth well into September, rather than having it virtually cease by August 1.

At the same time, erosion control isn't reduced by thinning. Studies have shown that, among the more common spacings between trees in plantations, litter production varied hardly at all, probably because increased crown volume and needle size compensated for decreases in density. For these reasons judicious thinning probably would not jeopardize the litter producing capacity of a stand nor would sediment production be increased significantly.

Partial cutting at periodic intervals permits timber production and watershed protection to continue in harmony. Clear cutting, too, can be acceptable if not used on steep watersheds or on those with highly erodible soils. In itself, clear cutting and felling does not harm the watershed; the danger of damage being done occurs during timber removal. For example, clear cutting an entire watershed in North Carolina without removing the severed trees increased streamflow by more than 60 percent in the following year without materially increasing stream sedimentation. On the other hand, clear cutting accompanied by removal of organic matter from the forest floor, as by fire, and with severe compaction of the soil by heavy logging equipment can do great harm.

Roads and Skid Trails

Logging truck roads and skid trails are among the leading contributors to watershed deterioration. Bare and loose soil plowed up in skidding is exposed to the rains, providing channels for rapid surface runoff. Roads and trails compact the soil, reducing infiltration and percolation rates, and stream channels are often choked with the sediment from these trails.

But planning in advance of logging can prevent much of this. Confine the roads to the ridge tops, away from the stream channels. Let the roads roll with the country as much as possible. Avoid unnecessary cuts and fills. Keep the grades down to no more than seven percent ordinarily or, in rare instances, 12 to 15 percent. Locate the roads far enough from water courses for the storm water to spread out and infiltrate the forest floor. Keep trucks, tractors, skidders, and logs out of and away from drainage channels. When logging is over, seed the abandoned roads with fescue, winter rye, or other grasses or legumes.

Skidding should be uphill to a ridgetop landing. This results in a fan shaped distribution of skid trails as they go downhill, dispersing any water moving down the trail rather than concentrating it as would be the case if the landing were in the bottom. Maintenance of undisturbed strips of forest floor 25 feet wide, plus an additional two feet for each one percent increase in slope along intermittent drainage and stream channels, will usually filter out the sediment. An exception is where high volumes of surface water are routed across the protective strip.

Soil and water coming from the public road system are often overlooked by landowners. Road foremen tend to "pull" the ditches too frequently and too deeply, destroying the cover holding the soil in place and speeding up the movement of water and soil. Downhill drains from culverts are straightened and deepened, speeding up the runoff and thereby increasing its sediment carrying capacity. A word to the road foreman will often work wonders. Where the best watershed protection is desired, "road water" runoff should be slowed and encouraged to spread out so it will drop its load of sediment. Plant trees along the drainage channel to slow bank cutting.

Healing of Gullies

Watershed managers have a natural inclination to completely heal a woodland gully in one expensive operation, which may include smoothing the area with a bulldozer, mulching, fertilizing, and seeding. It is far more economical to build a gully plug or small grassed dam and to plant three or more rows of loblolly pine around the gully rim as well as the most favorable spots within the gully. Water collecting behind the dam will provide a water hole for game, and willows will seed in along the water's edge naturally. As fertile topsoil lodges and builds up in stable flats within the gully, light seeded hardwoods and pine, too, will germinate and grow, speeding natural healing.

Summary

Finally, don't assume that doing nothing while nature takes its course is the best conservation. Begin any land management activities with a plan which takes into consideration the management objectives, be they timber production, game production or a variety of uses. And, remember, the key to good conservation lies in good supervision of all cultural activities, eternal vigilance, and an abiding love for the land.

Healing the Wounds. *A gully plug offers an economical way to heal woodland gullies. Build a grassed dam, then plant loblolly pines around the gully rim and within the gully area. Water collecting behind the dam will provide a waterhole for game.*

Suggested Reading

Broadfoot, W. M. 1960. Soil-water shortages and a means of alleviating resulting influences on southern hardwoods. Proc. 8th Annual LSU For. Symposium 1959: 115-119.

Coile, T. S. 1940. Soil changes associated with loblolly pine succession on abandoned agricultural land of the Piedmont Plateau. Duke Forestry Bull. #5.

Reinhardt, K. G. and Lull, H. W. 1969. Forests and floods, a reconsideration. Presented at the Society of American Foresters Annual Meeting in Miami on October 13, 1969.

Rogerson, T. L. 1967. Through fall in pole-sized loblolly pine as affected by stand density. Proc. Int. Symp. on Forest Hydrol., pp 187-190, illus. New York: Pergamon Press.

Trimble, G. R., Jr., and Sarty, R. S. 1957. How far from a stream should a logging road be located? Jour. Forestry 55: 339-341.

Ursic, S. J. 1963. Planting loblolly pine for erosion control in north Mississippi. U.S. Forest Serv. Res. Paper SO-3, 22 pp. illus. South Forest Expt. Sta. New Orleans, La.

Ursic, S. J. and Dendy, F. E. 1965. Sediment yields from small watersheds under various land uses and forest covers. Int. Fed. Inter-agency Sedimentation Conf. Proc. 1963: 47-52, illus, U.S. Dept. Agr. Misc. Pub. 970.

U.S.D.A. 1970. Erosion prevention and control on timber sales. Forest Service Manual. R-8 Supplement 160, pp. 2482.2-1-4.

Williston, H. L. 1965. Forest floor in loblolly pine plantations as related to stand characteristics. U.S. Forest Ser. Res. Note SO-26 3pp., illus.

Zahner, Robert 1959. Soil moisture utilization by southern forests. Proc. 8th Annual LSU For. Symposium 1959: 25-30.

Zahner, Robert and Whitmore, F. W. 1960. Early growth of radically thinned loblolly pine. Jour. Forestry 58: 628-634, Illus.

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